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Educational Product	
Educators	Grades 3-5

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The NASA "Why?" Files
The Case of the Phenomenal Weather

A Lesson Guide with Activities in Mathematics, Science, and Technology

The Case of the Phenomenal Weather lesson guide is available in electronic format through NASA Spacelink - one of NASA's electronic resources specifically developed for the educational community. This publication and other educational products may be accessed at the following address: **http://spacelink.nasa.gov/products**

A PDF version of the lesson guide for NASA "Why?" Files can be found at the NASA "Why?" Files web site: **http://whyfiles.larc.nasa.gov**

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For additional information about the NASA "Why?" Files, contact Shannon Ricles at (757) 864-5044 or e-mail **s.s.ricles@larc.nasa.gov**.

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Registered users of the NASA "Why?" Files may request an American Institute of Aeronautics and Astronautics (AIAA) classroom mentor. For more information or to request a mentor, e-mail **nasawhyfiles@aiaa.org**.

Program Overview

The tree house detectives are eager to go to the physics fair at Busch Gardens, but they are worried that bad weather will keep them from attending. Just off the coast of Africa is a tropical wave, and even though it looks really far away, they decide they need to learn more about weather forecasting just to make sure. They are glad they made that decision when they find out that even more is at stake as KSNN announces the winners of the environmental contest. They won!

As the tree house detectives set out to become amateur meteorologists, they visit NASA's S'COOL project and learn that clouds are not as simple as they thought. As the storm begins to strengthen in the Atlantic Ocean, they decide to visit Dr. D, a retired science professor, who offers them a few pointers about air pressure, predicting, probability, and forecasting. However, the storm continues to grow, and they know that it is time to speak to hurricane experts. They visit Dr. Lyons with the Weather Channel, the Hurricane Hunters, and NOAA (National Oceanic and Atmospheric Administration). They also get firsthand advice about hurricanes from a family in Miami who actually lived through Hurricane Andrew.

As the story continues, the storm develops into Hurricane Ichabod, a Category II hurricane. The tree house detectives seek help from a NASA "Why?" Files Kids Club at Thompson Elementary in Vero Beach, Florida who are playing the Hurricane Game. The class helps the tree house detectives learn more about hurricane watches and warnings and how to predict landfall. Join the tree house detectives to find out how the wind will blow and if they will get to go on their trip to Florida or if they had better stay home in Virginia!

National Geography Standards (grades 3-5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
The geographically informed person knows and understands				
The World in Spatial Terms				
How to use maps and other graphic representations, tools, and technologies to acquire, process, and report information from a spatial perspective	×	×	×	×
Places and Regions				
That people create regions to interpret Earth's complexity	×	×	×	×
Physical Systems				
The physical process that shapes the patterns of Earth's surface	×	×	×	×
Environment and Society				
How physical systems affect human systems	×	×	×	×
Uses of Geography				
How to apply geography to interpret the past				×
How to apply geography to interpret the present and plan for the future				×

National Science Standards (Grades K – 4)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Unifying Concepts and Processes				
Systems, orders, and organization	X	X	X	X
Evidence, models, and explanations	X	X	X	X
Change, constancy, and measurement	X	X	X	X
Evolution and equilibrium	X	X	X	X
Form and function	X	X	X	X
Science and Inquiry (Content Standard A)				
Abilities necessary to do scientific inquiry	X	X	X	X
Understanding about scientific inquiry	X	X	X	X
Physical Science (Content Standard B)				
Properties of objects and materials	X	X	X	X
Position and motion of objects	X	X	X	X
Light, heat, electricity, and magnetism	X	X	X	X
Earth and Space Science (Content Standard D)				
Properties of Earth materials	X	X	X	X
Objects in the sky	X	X	X	X
Changes in Earth and sky	X	X	X	X
Science and Technology (Content Standard E)				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
Ability to distinguish between natural objects and objects made by human beings	X	X	X	X
Science in Personal and Social Perspective (Content Standard F)				
Personal health	X	X	X	X
Changes in environment	X	X	X	X
Science and technology in local challenges	X	X	X	X
History and Nature of Science (Content Standard G)				
Science as a human endeavor	X	X	X	X

National Science Standards (Grades 5 – 8)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Unifying Concepts and Processes				
Systems, order, and organization	X	X	X	X
Evidence, models, and explanations	X	X	X	X
Change, constancy, and measurement	X	X	X	X
Evolution and equilibrium	X	X	X	X
Form and function	X	X	X	X
Science as Inquiry (Content Standard A)				
Abilities necessary to do scientific inquiry	X	X	X	X
Understanding about scientific inquiry	X	X	X	X
Physical Science (Content Standard B)				
Properties and changes of properties in matter	X			
Motion and forces	X	X	X	X
Transfer of energy	X	X	X	X
Earth and Space Science (Content Standard D)				
Structure of the Earth system	X	X	X	X
Science and Technology (Content Standard E)				
Abilities of technological design	X	X	X	X
Understanding about science and technology	X	X	X	X
Science in Personal and Social Perspectives (Content Standard F)				
Natural hazards	X	X	X	X
Risks and benefits	X	X	X	X
Science and technology in society	X	X	X	X
History and Nature of Science (Content Standard G)				
Science as a human endeavor	X	X	X	X
Nature of science	X	X	X	X

National Mathematics Standards (Grades 3 - 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Number and Operations				
Compute fluently and make reasonable estimates.			x	x
Algebra				
Use mathematical models to represent and understand quantitative relationships.	x	x	x	x
Geometry				
Specify location and describe spatial relationships using coordinate geometry and other representational systems.	x	x	x	x
Measurement				
Understand measurable attributes of objects and the units, systems, and processes of measurement.	x			x
Apply appropriate techniques, tools, and formulas to determine measurements.	x			x
Data Analysis and Probability				
Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	x	x	x	x
Select and use appropriate statistical methods to analyze data.	x	x	x	x
Develop and evaluate inferences and predictions that are based on data.	x	x	x	x
Understand and apply basic concepts of probability.	x	x	x	x
Problem Solving				
Solve problems that arise in mathematics and in other contexts.	x	x	x	x
Apply and adapt a variety of appropriate strategies to solve problems.	x	x	x	x
Monitor and reflect on the process of mathematical problem solving.	x	x	x	x
Communication				
Analyze and evaluate the mathematical thinking and strategies of others.				x
Connections				
Recognize and use connections among mathematical ideas.				x
Recognize and apply mathematics in contexts outside mathematics.				x
Representation				
Create and use representations to organize, record, and communicate mathematical ideas.	x	x	x	x
Use representations to model and interpret physical, social, and mathematical phenomena.	x	x	x	x

National Technology Standards (ITEA Standards for Technology Literacy, Grades 3 – 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Nature of Technology				
Standard 1: Students will develop an understanding of the characteristics and scope of technology.	x	x	x	x
Standard 2: Students will develop an understanding of the core concepts of technology.	x	x	x	x
Standard 3: Students will develop an understanding of the relationships among technologies and the connections between technology and other fields of study.	x	x	x	x
Technology and Society				
Standard 4: Students will develop an understanding of the cultural, social, economic, and political effects of technology.	x	x	x	x
Standard 5: Students will develop an understanding of the effects of technology on the environment.	x	x	x	x
Standard 6: Students will develop an understanding of the role of society in the development and use of technology.	x	x	x	x
Standard 7: Students will develop an understanding of the influence of technology on history.				x
Abilities for a Technological World				
Standard 12: Students will develop abilities to use and maintain technological products and systems.	x	x	x	x
The Designed World				
Standard 17: Students will develop an understanding of and be able to select and use information and communication technologies.	x	x	x	x

National Technology Standards (ISTE National Educational Technology Standards, Grades 3 – 5)

Standard	Segment 1	Segment 2	Segment 3	Segment 4
Basic Operations and Concepts				
Use Keyboards and other common input and output devices efficiently and effectively.	×	×	×	×
Discuss common uses of technology in daily life and the advantages and disadvantages those uses provide.	×	×	×	×
Social, Ethical and Human Issues				
Discuss common uses of tehcnology in daily life and the advantages and disadvantages those uses provide.	×	×	×	×
Discuss basic issues related to responsible use of technology and information and describe personal consequences of inappropriate use.	×	×	×	×
Technology Productivity Tools				
Use general purpse productivity tools and peripherals to support personal productivity, remediate skill deficits, and facilitate learning throughout the curriculum.	×	×	×	×
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	×	×	×	×
Technology Communication Tools				
Use technology tools for individual and collaborative writing, communication, and publishing activities to create knowledge products for audiences inside and outside the classroom.	×	×	×	×
Use telecommunication efficiently and effectively to access remote information, communicate with others in support of direct and independent learning, and pursue personal interests.	×	×	×	×
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	×	×	×	×
Technology Research Tools				
Use telecommunication and online resources to participate in collaborative problem-solving activities for the purpose of developing solutions or products for audiences inside and outside the classroom.	×	×	×	×
Use technology resources for problem solving, self-directed learning, and extended learning activities.	×	×	×	×
Determine when technology is useful and select the appropriate tools and technology resources to address a variety of tasks and problems.	×	×	×	×
Technology Problem-Solving and Decision-Making Tools				
Use technology resources for problem solving, self-directed learning, and extended learning activities.	×	×	×	×
Determine when technology is useful and select the appropriate tools and technology resources to address a variety of tasks and problems.	×	×	×	×

The NASA "Why?" Files
The Case of the
Phenomenal Weather

Segment 1

The tree house detectives are eager to go to the upcoming physics fair at Busch Gardens. Last year the fair was rained out, and they are hoping that the weather does not spoil the fun this year. They decide that they had better learn more about weather. Clouds seem to be the place to start, so the tree house detectives visit Dr. Lin Chambers at NASA Langley Research Center in Hampton, VA. They decide that they might need to know a little more about weather and they head to Dr. D's lab. Dr. D explains to the tree house detectives that the Sun is the driving force in weather and tells how air pressure plays an important role. While in the lab, the tree house detectives hear a weather update and learn that a tropical wave off the African coast has become a tropical depression. Now they have to worry not only about the physics fair but also their possible trip to Florida!

Objectives

The students will

- understand that weather changes from day to day.
- learn that water can be changed from one state to another by heating or cooling.
- learn that clouds affect weather and climate.
- understand the water cycle.
- learn the three main types of clouds.
- understand that the Sun is a major source of energy for weather.
- understand air pressure.
- learn that heat moves in predictable ways, flowing from warmer objects to cooler ones.
- learn how wind is created.
- learn how different environments support different organisms.
- understand that animals and plants need to adapt to survive.

Vocabulary

air pressure - measure of the force of air pressing down on the Earth's surface

cirrus - a thin white cloud usually of tiny ice crystals formed at altitudes of 6,000 to 12,000 meters

cumulus - a large cloud form having a flat base and rounded outlines often piled up like a mountain

condense - to make or become closer, more compact, concise, or dense

eye of a hurricane - the center of the hurricane that has low pressure and calm winds

particles - one of the very small parts of matter

physics - a science that deals with matter and energy and their actions upon each other in the fields of mechanics, heat, light, electricity, sound, and the atomic nucleus

prevailing wind - wind that blows more often from one direction than from any other direction

tropical depression - a tropical cyclone with maximum sustained winds less than 39 mph

tropical wave - a trough or cyclonic curvature maximum in the trade wind easterlies

tropics - tropical climate zone located between 30° latitude and the equator (0°) in each hemisphere

stratus - a cloud form extending over a large area at an altitude from 600 to 2100 meters

water vapor - water in a gaseous form, especially when below boiling temperature and when spread through the atmosphere

Video Component

Implementation Strategy

The NASA "Why?" Files is designed to enhance and enrich the existing curriculum. Two to three days of class time is suggested for each segment to fully use video, resources, activities, and the web site.

Before Viewing

1. Prior to viewing Segment 1 of *The Case of the Phenomenal Weather*, read the program overview (p. 5) to the students. List and discuss questions and preconceptions that students may have about weather, hurricanes, and tornadoes.
2. Record a list of issues and questions that the students want answered in the program. Determine why it is important to define the problem before beginning. From this list, guide students to create a class or team list of three issues and four questions that will help them better understand the problem. The following tools are available on the web site to assist in the process.

   Problem Board - Printable form to create student or class K-W-L chart

PBL Questions - Questions for students to use while conducting research

Problem Log - Printable log for students with the stages of the problem-solving process

The Scientific Method - Chart that describes the scientific method process

3. Focus Questions - Questions at the beginning of each segment help students focus on a reason for viewing. These can be printed from the web site ahead of time for students to copy into their science journals. Encourage students to take notes during the program to answer the questions. An icon will appear when the answer is near.
4. What's Up? Questions - Questions at the end of the segment help students predict what actions the tree house detectives should take next in the investigation process and how the information learned will affect the case. These can be printed from the web site ahead of time for students to copy into their science journals.

Careers

physicist
weather forecaster
atmospheric scientist
reporter
cloud-seeding expert
researcher
solar astronomer
hydrologist

View Segment 1 of the Video

For optimal educational benefit, view *The Case of the Phenomenal Weather* in 15-minute segments and not in its entirety. If you are viewing a taped copy of the program, you may want to stop the video when the Focus Question icon appears to allow students time to answer the question.

After Viewing

1. Have students reflect on the "What's Up?" questions asked at the end of the segment.
2. Discuss the Focus Questions.
3. Students should work in groups or as a class to discuss and list what they know about weather and tropical storms. As a class, reach a consensus on what additional information they need to know about weather and tropical storms before they can predict whether the tree house detectives will be attending the physics fair. Have the students conduct independent research or provide students with the information needed.
4. Have the students complete Action Plans, which can be printed from the web site, and then conduct independent or group research using books and internet sites noted on the Research Rack section of the NASA "Why?" Files web site. Educators can also search for resources by topic, episode, and media type under the Educator's main menu option Resources.
5. Choose activities from the educator guide and web site to reinforce concepts discussed in the segment. The variety of activities is designed to enrich and enhance your curriculum. Activities may also be used to help students "solve" the problem along with the tree house detectives.
6. Have the students work individually, in pairs, or in small groups on the Problem-Based Learning (PBL) activity on the NASA "Why?" Files web site.
7. To begin the PBL activity, read the scenario to the students.
8. Read and discuss the various roles involved in the investigation. Have each student choose his/her role.
9. Print the criteria for the investigation and distribute.
10. Have students use the Research Rack located on the web site and the online tools that are available.
11. Having students reflect in their journals what they have learned from this segment and from their own experimentation and research is one way to assess the students. In the beginning, students may have difficulty reflecting. To help students, give them specific questions that are related to the concepts to reflect upon.
12. Have students complete a Reflection Journal, which can found in the Problem-Solving Tool section of the online PBL investigation or in the Instructional Tools section of the Educator's area.
13. The NASA "Why?" Files web site provides educators with general and specific evaluation tools for cooperative learning, scientific investigation, and the problem-solving process.

Resources (additional resources located on web site)

Books

Allen, David: *Air: All About Cyclones, Rainbows, Clouds, Ozone and More*. Greey de Pencier Books, 1993, ISBN: 1895688086.

De Paola, Tommie: *The Cloud Book*. Holiday House, 1985, ISBN: 0823405311.

Edom, Helen and Moira Butterfield: *Usborne Science Activities: Science with Air.* Usborne Publishing Ltd., 1991, ISBN: 0746009720.

Gibbons, Gail: *Weather Forecasting*. Aladdin Paperbacks, 1993, ISBN: 0689716834.

Kahl, Jonathan D.: *National Audubon Society First Field Guide Weather (National Audubon First Field Guide)*. Scholastic Trade, 1998, ISBN: 0590054880.

Simon, Seymour: *Weather.* Harpercollins Juvenile Books, 2000, ISBN: 068817521X.

Videos

Eyewitness: Weather. ASIN: 6304165331

Web Sites

S'COOL
Official NASA web site for the Students' Cloud Observations On-Line Project. Register your class to help NASA gather real-time data to study clouds and the atmosphere. Resources are available for both students and teachers.
http://asd-www.larc.nasa.gov/SCOOL/

The Weather Channel
Check your local forecast or the weather across the country. Explore "Weather in the Classroom" and find great resources for you and your students.
http://www.weather.com

The Weather Unit
This site is a complete unit on weather and related activities in math, science, art, music, social studies and more.
http://faldo.atmos.uiuc.edu/WEATHER/weather.html

Activities and Worksheets

Particular Particles

Purpose

To learn that water vapor condenses around particles in the sky to form clouds

Materials

rectangular pan
small drinking glass with a large mouth
large rectangular pencil eraser
table salt
tap water

Procedure

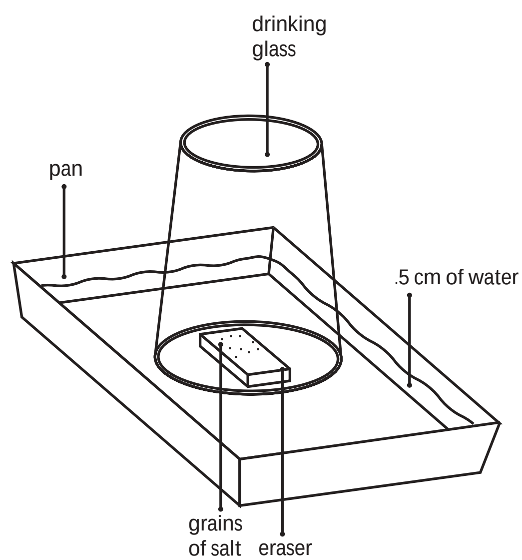
1. Fill the pan with .5 cm of water.
2. Put the eraser in the middle of the pan.
3. Place approximately 10 salt grains onto the eraser.
4. Put the drinking glass over the eraser so that the mouth of the glass is resting on the pan.
5. Observe the salt grains every 5 minutes for a total of 20 minutes.

Conclusion

1. What happened to the salt grains?
2. How did the water droplets get from the pan to the salt grains?
3. Based on your results from this activity, what could you predict is in the atmosphere that makes cloud formation possible?

Extension

Find a window where the sun is coming through. Look closely for tiny particles floating around in the stream of sunlight.



It's Time to Get Cirrus with Clouds!

Clouds come in many shapes and sizes, but all clouds are made up of billions of tiny water drops or ice crystals. Air cools when it rises through the atmosphere. If it cools enough, water vapor in the air condenses to form clouds. There are three basic types of clouds – wispy "cirrus" clouds, fluffy-white-heaped "cumulus" clouds, and huge blanket layers of "stratus" clouds.

Luke Howard (1772-1864), an English scientist, was the person who devised the classification of clouds we use today. Since Latin was the language of science at that time, Howard used Latin words that best described the shape of the clouds. For example, cirrus means "curl of hair," cumulus means "heap," and stratus means "layer."

Materials

altitude chart (p. 18)
cloud chart (p. 19)
cotton balls
sheet cotton
glue
black felt-tip marker
dark colored construction paper

Clouds are also identified by how high in the sky they are. For example, "cirro-" means high, "alto-" means medium, and "nimbo-" means low. Meteorologists use a combination of cloud type and altitude to name most clouds; so, altocumulus clouds, for instance, are fluffy cumulus clouds at a medium-high altitude.

Purpose

To make models of different cloud types

Procedure

1. Use the cloud and altitude charts as guides for creating clouds. Students may want to transfer the altitude numbers onto the construction paper.
2. Make various types of clouds by gluing different amounts of cotton onto the construction paper. Here are some tips to get started:
3. Pulling the cotton into thin, wispy strands can make cirrus clouds.
4. To make a cumulus cloud, puff up a ball of cotton and paste it on the paper.
5. For a stratus cloud, cut off a piece from the sheet cotton, pull the layers apart, and glue it to the paper.
6. Use the black marker to turn some clouds into nimbus precipitation clouds.
7. Using the completed cloud models and cloud chart as a reference, identify the types of clouds that are in the sky today.

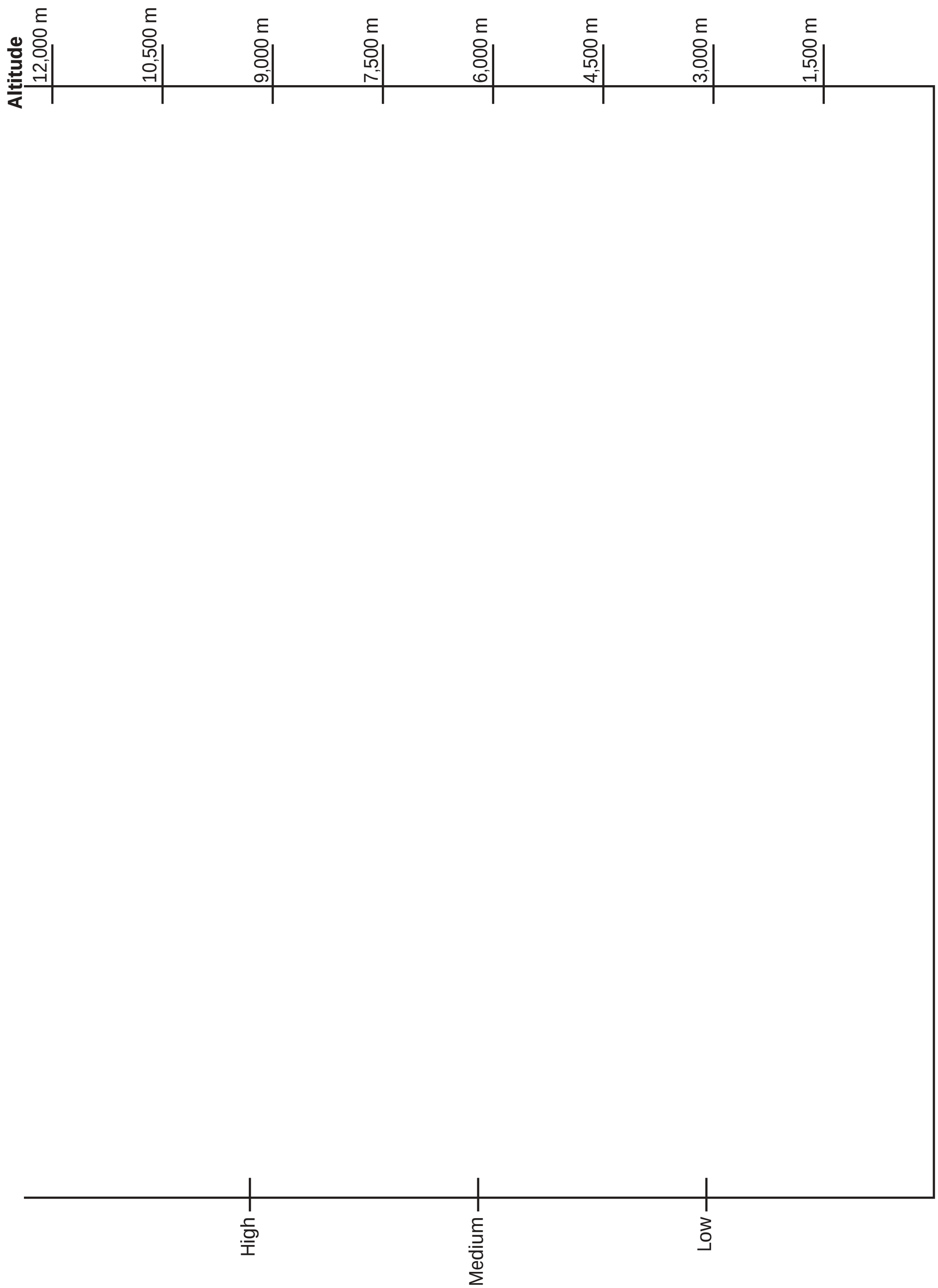
Conclusion

1. Which cloud types are the highest?
2. Which clouds are the lowest?
3. Which clouds are the largest?
4. What are middle-altitude clouds called?
5. What clouds are made of ice crystals? Why are they icy?

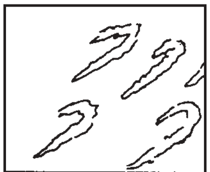
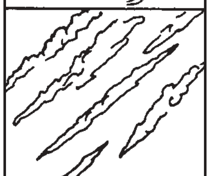
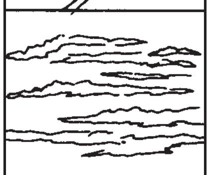
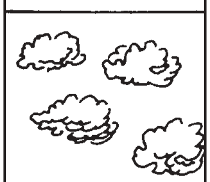
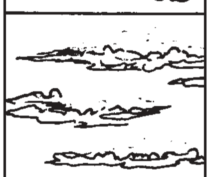
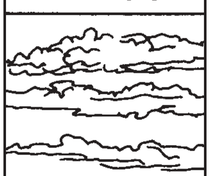
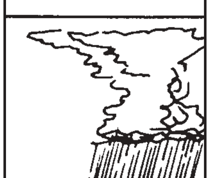
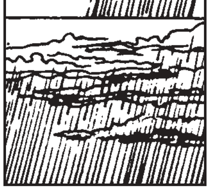
Extension

Use a cloud reference book or field manual and research the type of weather that is often associated with each cloud type.

Altitude Chart



Cloud Chart

Shape	Name	Altitude	Description
	Cirrus	Above 6000 M	Thin, wispy, made of ice crystals On bright night, moon can be seen
	Cirrocumulus	Above 6,000 M	Thin, white puffs of ice crystals Form ripples in high sky
	Cirrostratus	Above 6,000 M	Thin sheet of white ice crystals Make sky look milky
	Altocumulus	6,000 M - 1,800 M	Small, puffy globules ranging from white to gray in color
	Altostratus	6,000 M - 1,800 M	Thin, layered veil Sun seen as bright spot
	Stratus	1,800 M	Low, uniform, gray layers Usually form drizzle
	Cumulus	1,800 M	Dense, white, and billowy with flat base, single or closely packed
	Cumulonimbus	Very Low	Large, towering, dark gray, usually form thunderstorm or heavy rain
	Nimbostratus	Very Low	Densely layered, dark gray Usually form overcast sky or dense, steady rain

Cyclical Cycles

Purpose

To understand that water can be changed from one state to another by heating and cooling through the process of the water cycle

Materials

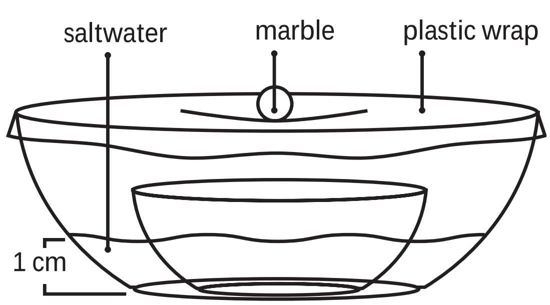
large, clear glass bowl
small glass bowl
pitcher of clean water
salt
stirring spoon
plastic wrap
ruler
small marble

Procedure

1. Put water into the large bowl until it is about 1cm deep.
2. Add several dashes of salt to the water and stir with the spoon until all the salt grains have completely disappeared. Have a volunteer taste the salty water.
3. Place the small bowl in the center of the large bowl.
4. Cover the large bowl with the plastic wrap. Be sure the plastic wrap clings to the sides of the bowl.
5. Gently set your marble on top of the plastic wrap. Make sure the marble is directly over the small bowl and causes the wrap to sag slightly.
6. Carefully move your bowl to a warm, sunny spot for a few hours. A heat lamp could also be used to reduce experiment time.
7. Remove the plastic wrap and have a volunteer taste the water inside the small bowl.

Conclusion

1. After removing the bowl from the sunlight, describe the changes that have taken place inside the bowl.
2. What caused drops of water to form on the plastic wrap and sides of the bowl?
3. What does the large bowl of saltwater represent in nature?
4. Is the water in the small bowl fresh or salty? Why?
5. Explain how the three-step process of the water cycle is shown in this activity.



Putting on the Pressure

The atmosphere of Earth is over 600 km thick, and the weight of all that air presses down onto the Earth's surface. The downward force exerted by the weight of air is called its pressure. At the surface of the Earth, the molecules of air are more tightly squeezed together, making the air denser at the bottom of the atmosphere than at higher altitudes. Air density and pressure are greatest at sea level. Air pressure on the surface of the Earth is not always equal due to the heating and cooling of the Earth's surface. Heat makes the molecules of air move and rise and this movement makes the air less dense and thus less heavy. As the warm air rises, the molecules leave the area that is being heated, creating an area of lower air pressure. The reverse is true when the surface of the Earth is cooled.

Air pressure is measured with a barometer. The most common type is an aneroid barometer that measures the expansion and contraction of an airless metal box as the pressure changes. Follow the directions below to make a simple aneroid barometer to use in your class or at home.

Materials

large jar
ruler
large balloon
2 drinking straws
scissors
tape
pen
poster board
clay
science journal

Diagram 1

Procedure

1. Use the scissors to cut off the balloon's neck.
2. Stretch the balloon over the mouth of the jar. See diagram 1.
3. Use tape to seal the balloon to the jar and make sure there are no leaks.
4. Tape two straws together end to end.
5. Cut a small triangle out of the poster board and tape it to one end of the straws.
6. Tape the other end of the straws to the top of the balloon. See diagram 2.
7. Make a small ball out of the clay and place the ruler in the middle of the clay so that the ruler is standing perpendicular to the table.
8. Position the jar so that the pointed end of the triangle overlaps the cm edge of the ruler, but make sure it does not touch the ruler. See diagram 3.
9. To measure the air pressure, observe where the pointer is located on the ruler and record in your science journal.
10. Check the position of the pointer at the same time each day and record.

Conclusion

1. How do the readings vary day to day? Week to week?
2. Is there any difference between sunny and rainy days? Why or why not?

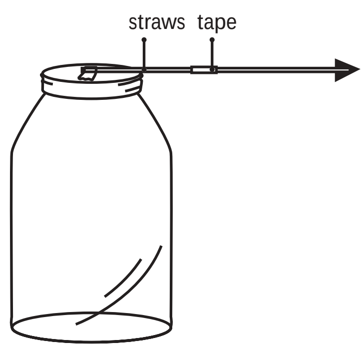


Diagram 2

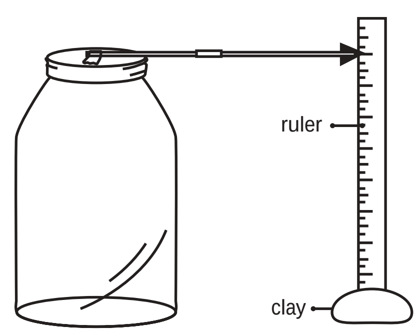


Diagram 3

Convection to Perfection

Purpose

To learn that heat moves in predictable ways, flowing from warmer objects to cooler ones

Materials

large jar or aquarium
water
small cup
food coloring
rubber band
plastic wrap
skewer or sharp pencil
science journal

Procedure

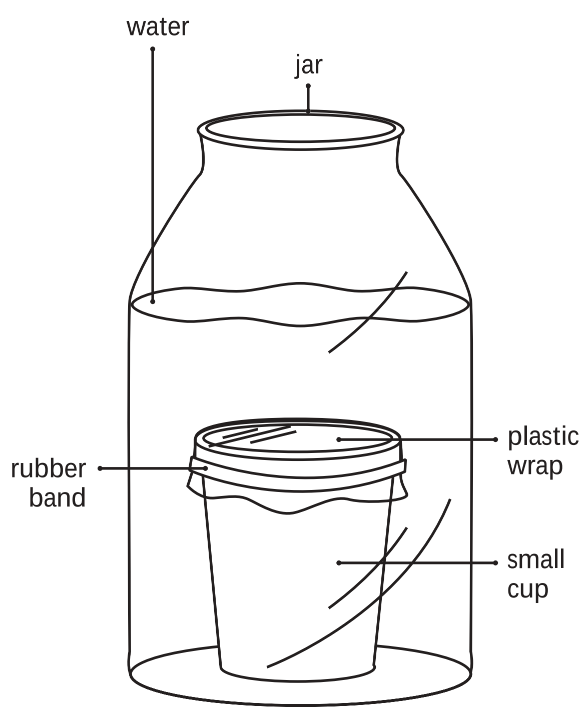
1. Fill the cup with hot water.
2. Add a few drops of food coloring and stir with skewer.
3. Cover the cup with plastic wrap and secure with the rubber band.
4. Place the cup in the center of the jar.
5. Carefully fill the jar with cold water so that the water goes over the cup and nearly to the top of the jar. See diagram.
6. Use the skewer to poke a hole in the plastic wrap and observe.
7. Record your observations in your science journal.

Conclusion

1. Explain what happened and why.
2. How does what happened help explain cloud formation?

Extension

Fill two equally sized jars, one with hot water and one with cold. Add yellow food coloring to the cold water and blue food coloring to the hot. Place a piece of poster board over the open end of one jar. Hold the poster board firmly in place and flip the jar upside down, placing it on top of the other jar. Position the jars so that the lips of each jar are lined up. Slowly and carefully pull the poster board from between the two jars. Observe. Ask other students to guess which jar was hot and which jar was cold.



Windy Wind

Purpose

To understand how wind is created

Materials

2 plastic 2-liter bottles
30 cm of plastic tubing
scissors
food coloring
tape
clay
ruler
marker
pitcher of water
stopwatch (optional)
ice pick or hand drill

Teacher Prep

1. Cut the tops off each bottle.
2. Drill a hole in each bottle approximately 10 cm from the bottom.

Procedure

1. For safety purposes, seal the cut edges of the bottles with tape.
2. From the bottom of each bottle, measure and mark 10 cm, 15 cm, 20 cm, 25 cm, and so on to the top of the bottle. See diagram 1.
3. To connect the bottles, place the ends of the plastic tube in the hole of each bottle. See diagram 2
4. Place clay around the plastic tube and the bottle to seal the opening.
5. Stand the bottles upright and side by side.
6. Fill the pitcher with water, add food coloring, and stir.
7. Fill one bottle with the colored water to the level of the tube.
8. Completely fill the other bottle to the top.
9. Observe what happens and record your observations in your science journal.
10. Experiment with different amounts of water in each bottle.
11. Use a stopwatch or clock with a second hand to determine the amount of time it takes for the various amounts of water to level off.

Conclusion

1. What happened to the water levels? Why?
2. How does what happened explain wind?

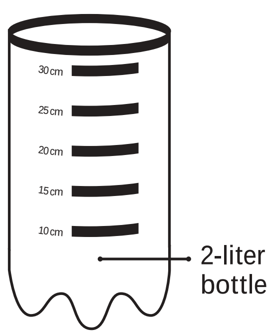


Diagram 1

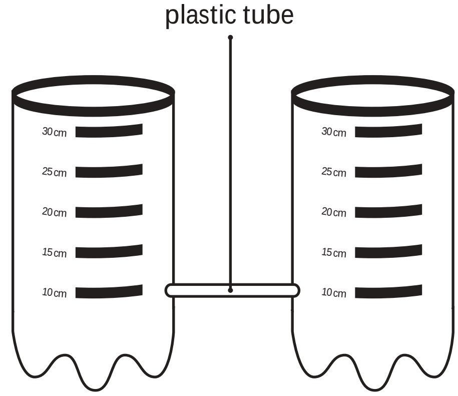


Diagram 2

Answer Key

Particular Particles

1. Each salt grain was covered with a droplet of water.
2. Some of the water evaporated and turned into water vapor. This water vapor floated inside the glass until it came in contact with the grains of salt. Once the water vapor touched the cooler salt grains, it condensed and formed a water drop.
3. There are particles floating in the atmosphere. Water vapor condenses around floating particles (such as dust and pollen) and forms tiny droplets around each particle. Millions of these tiny droplets cluster together to form clouds.

It’s Time to get Cirrus about Clouds

1. Cirrus clouds are the highest clouds.
2. Stratus clouds are the lowest.
3. Cumulus clouds are the largest.
4. Clouds that begin with the prefix alto. For example, altocumulus or altostratus.
5. Cirrus clouds are made of ice crystals caused by the lower temperatures at higher altitudes.

Cyclical Cycles

1. Water droplets have formed on the plastic wrap and sides of the large bowl. There is some water inside the small bowl.
2. The sunlight heated the water in the bowl, turning it into water vapor. As the water vapor rose, it touched the plastic wrap and the sides of the bowl, causing the water vapor to cool and change back to droplets of water called condensation.
3. The water contained in the oceans.
4. It is fresh water. The sunlight evaporated the water, but the salt does not evaporate and is left behind in the large bowl.
5. Evaporation - the water is being heated by the Sun and turned to water vapor.
   Condensation - water vapor is cooling and turning back to water droplets.
   Precipitation – water is collecting underneath the marble until it gets heavy enough to fall into the small bowl.

Putting on the Pressure

1. The air pressure readings should vary from day to day and week to week. Variances will differ.
2. There will be a difference between sunny days and rainy days. Sunny days usually have higher pressure and rainy days have lower pressure.

Convection to Perfection

1. When a gas or liquid is warmed, its molecules move apart. The fluid takes up more space, but the number of molecules is the same, so it becomes less dense than its cooler surroundings. Because it is less dense, it rises through the cooler fluid until it reaches a level where the substance above is less dense than it is. The fluid then cools and sinks. When a gas or liquid transfers heat like this, it is called convection.
2. Clouds are formed when air near the Earth’s surface is heated and rises just like the hot water. As the hot air rises, the water vapor in the air cools and condenses, forming clouds. As more water vapor rises and cools, the clouds will either become saturated and rain will occur, or the clouds will begin to sink and dissipate.

Windy Wind

1. Even though the hole in the bottle with the least amount of water was covered by water, the water from the full bottle still flowed into it. There was less pressure in the bottle with less water, and the water continued to flow until the pressure difference between the bottles evened out.
2. Air flows from a high-pressure area to a low-pressure area, much like water flows from a higher to a lower level. The greater the differences between pressure areas, the greater the wind speed.